

The Scottish Mathematical Council

www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2012–2013

Entries must be the unaided efforts of individual pupils.

Solutions must include explanations and answers without explanation will be given no credit.

Do not feel that you must hand in answers to all the questions.

CURRENT AND RECENT SPONSORS OF MATHEMATICAL CHALLENGE ARE

The Edinburgh Mathematical Society, The Maxwell Foundation, Professor L E Fraenkel,

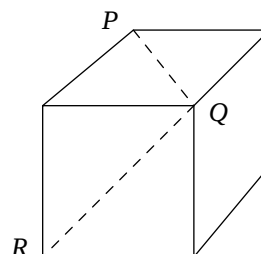
The London Mathematical Society and The Scottish International Education Trust.

The Scottish Mathematical Council is indebted to the above for their generous support and gratefully acknowledges financial and other assistance from schools, universities and education authorities.

Particular thanks are due to the Universities of Aberdeen, Edinburgh, Glasgow, Heriot Watt, Stirling, and to Preston Lodge High School, Bearsden Academy, Beaconsfield School and Northfield Academy.

Middle Division: Problems 2

- M1.** PQ and QR are diagonals on two faces of a cube as shown. What is the size of $\angle PQR$?

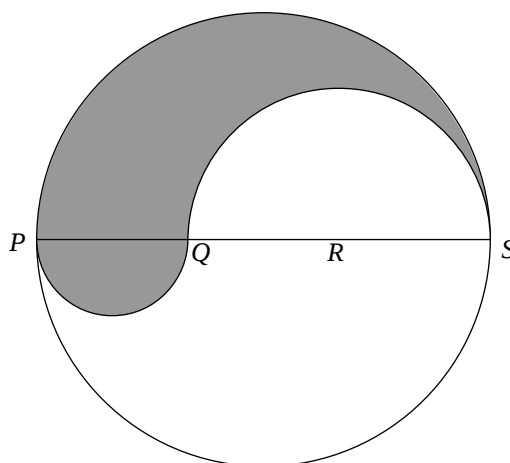


- M2.** Very shortly after leaving Elmouth by bus on the half-hour ride to Elwick one day, we met a bus coming towards us. I wondered to myself how many such buses we should meet before we reached our destination. There is a ten minute service each way.

I assumed that all buses concerned travelled on time and at a constant speed. How many buses should we have met before we reached our destination?

- M3.** Susan has 20 coins in her purse. She has only 10p, 20p and 50p coins and their total value is £5. She has more 50p coins than 10p coins. How many coins of each type does she have?

- M4.** $PQRS$ is the diameter of a circle whose radius is r . The lengths PQ , QR and RS are equal. Semicircles are drawn on PQ and QS to create the shaded figure shown in the diagram. Find the perimeter of the shaded figure.



SEE OVER FOR QUESTION M5.



Mathematical Challenge Problems 2

MIDDLE DIVISION 2012–2013

PLEASE USE CAPITALS TO COMPLETE

SURNAME

OTHER NAME(S)
(underline the one
you prefer)

SCHOOL

AGE

YEAR OF STUDY

S

FOR OFFICIAL USE

Marker

Marks

1	2	3	4	5

Total

— — — — - C U T A L O N G H E R E — — — —

Please write your solutions on A4 paper and staple the above form to them.

PLEASE WRITE YOUR NAME ON EVERY PAGE.

Send your entry directly or through your school to :

Simon Malham

School of Mathematical and Computer Science

Heriot Watt University

Edinburgh EH14 4AS

For further information on the competition, please see the Information Circular, which has been distributed to all secondary schools. Please contact the local organiser, whose name and address are given above, if you require a further copy.

- M5.** Show that the maximum range of an aeroplane is extended by a factor of $\frac{1}{3}$ when there is a second identical support plane which sets off at the same time to provide in-air refuelling. The support plane must return safely to the starting point.

Now consider the situation where there are two identical support planes which can (instantaneously) refuel each other or the original plane as required. The support planes set off at the same time as the original plane and both must return safely to the starting point. By how much can the maximum range of the plane be extended?

END OF PROBLEM SET 2

CLOSING DATE FOR RECEIPT OF SOLUTIONS :

15th February 2013

Look on the SMC web site: www.scot-maths.co.uk for information about Mathematical Challenge